

TABLE OF CONTENTS

Section		Page
1.0 EXECUTIVE SUMMARY		1-1
1.1 Introduction and Coordinated Review		1-1
1.2 Project Applicant, Name and USACE/EOEA/DRI Number.....		1-1
1.3 Summary of Project Purpose and Need.....		1-2
1.4 Summary of Alternatives Analysis.....		1-2
1.5 Summary of Proposed Alternative		1-3
1.5.1 Project Overview		1-3
1.5.2 Project Location.....		1-3
1.5.3 Project Changes Since filing ENF		1-4
1.5.4 Anticipated Project Schedule.....		1-6
1.6 Summary of Environmental Effects, Benefits and Mitigation		1-6
1.7 List of Required Permits and Approvals –Proposed Alternative		1-24
2.0 PROJECT PURPOSE AND NEED.....		2-1
2.1 Introduction		2-1
2.2 Project Purpose and Need		2-1
2.3 Purpose and Scope of the Environmental Impact Statement (EIS) / Environmental Impact Report (EIR)		2-2
2.4 References.....		2-3
3.0 ALTERNATIVES ANALYSIS		3-1
3.1 Geographic Scope and Primary Project Criteria		3-1
3.2 Assessment of Energy Generating Technologies		3-2
3.2.1 Impact Assessment of Fossil Fuel Fired Power Plants		3-2
3.2.1.1 Mainland Plants.....		3-2
3.2.1.1.1 Natural Gas Fired Power Plants.....		3-2
3.2.1.1.2 Oil-Fired Power Plants.....		3-5
3.2.1.1.3 Coal-Fired Power Plants		3-6
3.2.1.2 Coastal Plants		3-8
3.2.1.2.1 Coastal Natural Gas Fired Power Plants		3-8
3.2.1.2.2 Coastal Oil-fired Power Plants		3-8
3.2.1.2.3 Coastal Coal-fired Power Plants.....		3-9
3.2.2 Renewable Technologies		3-10
3.2.2.1 Photovoltaic (Pv)/Solar		3-10
3.2.2.1.1 Reliability.....		3-10
3.2.2.1.2 Current Technology Status		3-11
3.2.2.1.3 Ability to Serve Regional Needs.....		3-11
3.2.2.1.4 Affected Environment		3-12
3.2.2.1.5 Environmental Impacts		3-12
3.2.2.1.6 Summary of Findings		3-12
3.2.2.2 Tidal		3-13
3.2.2.2.1 Reliability.....		3-13
3.2.2.2.2 Current Technology Status		3-13
3.2.2.2.3 Ability to Serve Regional Needs.....		3-14
3.2.2.2.4 Affected Environment		3-14
3.2.2.2.5 Environmental Impacts		3-14
3.2.2.2.6 Summary of Findings		3-15
3.2.2.3 Biomass		3-15
3.2.2.3.1 Reliability.....		3-15
3.2.2.3.2 Current Technology Status		3-16
3.2.2.3.3 Ability to Serve Regional Needs.....		3-16
3.2.2.3.4 Affected Environment		3-16
3.2.2.3.5 Environmental Impacts		3-17
3.2.2.3.6 Summary of Findings		3-18

3.2.2.4 Hydroelectric	3-18
3.2.2.4.1 Reliability.....	3-18
3.2.2.4.2 Current Technology Status	3-19
3.2.2.4.3 Ability to Serve Regional Needs	3-19
3.2.2.4.4 Affected Environment	3-19
3.2.2.4.5 Environmental Impacts	3-19
3.2.2.4.6 Summary of Findings.....	3-20
3.2.2.5 Wave.....	3-20
3.2.2.5.1 Reliability.....	3-21
3.2.2.5.2 Current Technology Status	3-21
3.2.2.5.3 Ability to Serve Regional Needs	3-21
3.2.2.5.4 Affected Environment	3-22
3.2.2.5.5 Environmental Impacts	3-22
3.2.2.5.6 Summary of Findings.....	3-23
3.2.2.6 Wind.....	3-23
3.2.2.6.1 Reliability.....	3-23
3.2.2.6.2 Current Technology Status	3-23
3.2.2.6.3 Ability to Serve Regional Needs	3-24
3.2.2.6.4 Affected Environment	3-25
3.2.2.6.5 Environmental Impacts	3-25
3.2.2.6.6 Summary of Findings.....	3-25
3.2.3 Summary of Findings and Comparison of Energy Generating Technologies	3-26
3.3 No Action Alternative / Permit Denial	3-26
3.4 Wind Park Alternative Site Analysis.....	3-28
3.4.1 Preliminary Site Screening Criteria.....	3-28
3.4.2 Screening Analysis Process	3-29
3.4.2.1 Upland.....	3-29
3.4.2.1.1 Massachusetts Military Reservation/Otis Air Force Base.....	3-29
3.4.2.1.2 Searsburg, Vermont.....	3-30
3.4.2.1.3 Princeton, Massachusetts	3-30
3.4.2.1.4 Skinner/Kibby Townships, Maine.....	3-30
3.4.2.1.5 Redington Pond/Black Nubble Mountain, ME	3-31
3.4.2.1.6 Connecticut Department of Transportation Site	3-31
3.4.2.1.7 Greenfield, Massachusetts.....	3-31
3.4.2.1.8 Hoosac Mountain Range, Florida MA	3-32
3.4.2.1.9 Summary of Findings and Comparisons of Upland Alternatives	3-32
3.4.2.2 Offshore.....	3-33
3.4.2.2.1 Block Island, Rhode Island	3-33
3.4.2.2.2 South of Martha's Vineyard, Massachusetts.....	3-33
3.4.2.2.3 Cape Ann, Massachusetts	3-34
3.4.2.2.4 Vinalhaven Island, Maine	3-34
3.4.2.2.5 Nantucket Shoals, Massachusetts	3-34
3.4.2.2.6 Nantucket Sound, Massachusetts	3-35
3.4.2.2.7 Boston Harbor and Vicinity, Massachusetts	3-35
3.4.2.2.8 New Bedford Harbor and Vicinity, Massachusetts	3-35
3.4.2.2.9 Portland Harbor and Vicinity, Maine	3-36
3.4.2.2.10 Summary of Findings and Comparison of Offshore Alternatives.....	3-36
3.4.3 Detailed Analysis of Alternatives.....	3-37
3.4.3.1 Introduction and Description of Alternatives	3-37
3.4.3.2 Environmental Resources Review	3-39
3.4.3.2.1 Protected Avian Species and Avian Resources	3-39
3.4.3.2.2 Geology and Soils/Sediments.....	3-49
3.4.3.2.3 Oceanography	3-55
3.4.3.2.4 Protected Marine Species	3-60
3.4.3.2.5 Fisheries.....	3-64
3.4.3.2.6 Benthos.....	3-76

3.4.3.2.7 Upland Environmental Resources	3-82
3.4.3.2.8 Aviation	3-87
3.4.3.2.9 Telecommunications	3-90
3.4.3.2.10 Navigation.....	3-91
3.4.3.2.11 Cultural / Historical Properties.....	3-93
3.4.3.2.12 Aesthetic/Landscape/Visual.....	3-100
3.4.3.2.13 Recreation	3-103
3.4.3.2.14 Noise.....	3-107
3.4.3.2.15 Water Quality and Water Resources	3-109
3.4.3.2.16 Electrical and Magnetic Fields	3-113
3.4.3.2.17 Air and Climate.....	3-114
3.4.3.2.18 Safety.....	3-118
3.4.3.2.19 Socio-Economic Conditions	3-119
3.4.3.3 Engineering and Economics.....	3-122
3.4.3.3.1 Engineering.....	3-122
3.4.3.3.2 Economic Analysis	3-127
3.4.3.4 Environmental Consequences	3-131
3.4.3.4.1 Protected Avian Species and Avian Resources	3-131
3.4.3.4.2 Geology and Soils/Sediments.....	3-144
3.4.3.4.3 Oceanography.....	3-150
3.4.3.4.4 Protected Marine Species	3-152
3.4.3.4.5 Fisheries	3-159
3.4.3.4.6 Benthos	3-166
3.4.3.4.7 Upland Environmental Resources	3-177
3.4.3.4.8 Aviation	3-182
3.4.3.4.9 Telecommunications	3-184
3.4.3.4.10 Navigation.....	3-187
3.4.3.4.11 Cultural/Historical Properties.....	3-190
3.4.3.4.12 Aesthetic/Landscape/Visual.....	3-196
3.4.3.4.13 Recreation	3-202
3.4.3.4.14 Noise	3-208
3.4.3.4.15 Water Quality and Water Resources	3-212
3.4.3.4.16 Electrical and Magnetic Fields	3-216
3.4.3.4.17 Air and Climate.....	3-219
3.4.3.4.18 Safety.....	3-220
3.4.3.4.19 Socio-Economic Impacts	3-223
3.4.3.5 Summary of Detailed Analysis of Alternatives.....	3-229
3.4.4 Comparison of Nantucket Sound Alternatives	3-235
3.4.4.1 Nantucket Sound Project Design Siting Criteria	3-235
3.4.4.2 Monomoy / Handkerchief Shoal	3-236
3.4.4.3 Tuckernuck Shoal.....	3-236
3.4.4.4 Horseshoe Shoal	3-236
3.4.4.5 Summary of Findings and Comparison of Nantucket Sound Alternatives	3-237
3.5 Submarine and Upland Cable Routes for the Applicants Proposed Site	3-237
3.5.1 Introduction	3-237
3.5.2 Siting Criteria	3-237
3.5.3 Description of Route Selection.....	3-238
3.5.3.1 Alternative Route #1 – Yarmouth – New Hampshire Avenue Landfall and Transmission Line Route	3-239
3.5.3.2 Alternative Route #2 – Mashpee – Mashpee Neck Road Town Landing and Transmission Line Route	3-240
3.5.3.3 Alternative Route #3 – Mashpee Bryants Cove/Willowbend Landfall and Willowbend Transmission Line Route	3-242
3.5.3.4 Alternative Route #4 – Cotuit – Main Street Landfall and Transmission Line Route.....	3-243
3.5.3.5 Alternative Route #5 – Point Gammon – Whale Road Landfall and Transmission Line Route.....	3-245

3.5.3.6 Alternative Route #6 – Hyannis Inner Harbor – Lewis Bay Road Landfall and Transmission Line Route.....	3-246
3.5.4 Screening Criteria	3-247
3.5.4.1 Installation and Maintenance Complexity.....	3-248
3.5.4.2 Environmental Impact Criteria.....	3-249
3.5.4.3 Cost of Facilities.....	3-251
3.5.4.4 Reliability	3-252
3.5.5 Application of Screening Criteria.....	3-252
3.5.6 Selection of Preferred Route	3-253
3.5.7 Conclusion on Preferred Route Selection.....	3-253
3.6 References	3-254
4.0 PROJECT DESCRIPTION OF APPLICANT'S PROPOSED ACTION	4-1
4.1 Description of the Wind Park	4-1
4.1.1 Wind Turbine Generators (WTGs)	4-2
4.1.1.1 Nacelle.....	4-2
4.1.1.2 Rotor	4-2
4.1.1.3 Tower	4-2
4.1.1.4 Marine Use Design	4-2
4.1.1.5 Life Span.....	4-3
4.1.2 Configuration of WTGs	4-3
4.1.3 Foundation System Design	4-4
4.1.3.1 Introduction	4-4
4.1.3.2 Monopile	4-5
4.1.3.3 Foundation System Design Criteria	4-5
4.1.3.4 Maintenance and Service Access to the WTG.....	4-6
4.1.4 Electrical Service Platform (ESP)	4-6
4.1.5 Inner-Array Cables.....	4-7
4.2 Description of the Proposed Transmission Facilities	4-8
4.2.1 Submarine 115 kV Transmission Cable System	4-8
4.2.2 Upland 115 kV Transmission Cable System	4-8
4.2.3 Ancillary Structures.....	4-9
4.3 Construction.....	4-9
4.3.1 Wind Turbine Generator Installation	4-9
4.3.2 Electric Service Platform Installation	4-11
4.3.3 33 kV Inner-array Submarine Transmission Cable System Installation	4-12
4.3.4 115 kV Submarine Transmission Cable System Installation	4-12
4.3.5 Landfall Transition Installation	4-14
4.3.6 Upland Transmission Line Installation.....	4-17
4.4 Operations and Maintenance Plan	4-18
4.5 Decommissioning	4-20
4.6 Solid and Hazardous Materials.....	4-20
4.6.1 WTG Fluid Containment	4-20
4.6.2 ESP Fluid Containment.....	4-21
4.7 Oil Spill Planning, Preparedness, and Response.....	4-21
4.8 Security	4-22
4.9 Safety	4-22
5.0 ENVIRONMENTAL RESOURCES AND CONSEQUENCES FOR THE APPLICANT'S PROPOSED ALTERNATIVE	5-1
5.1 Geology and Sediment Conditions	5-1
5.1.1 Introduction	5-1
5.1.2 Field Studies Completed	5-1
5.1.2.1 Marine Geophysical/Hydrographic Surveys	5-2
5.1.2.2 Geologic and Geotechnical Program.....	5-4
5.1.3 Existing Conditions	5-6
5.1.3.1 Geologic Framework.....	5-6

5.1.3.2 Conditions Outside of Massachusetts Waters	5-8
5.1.3.3 Conditions Inside of Massachusetts Waters and Onshore	5-11
5.1.4 Analysis of Impacts	5-12
5.1.4.1 Potential Impacts to Marine Geology Outside of Massachusetts Waters	5-13
5.1.4.2 Potential Impacts to Marine Geology Inside Massachusetts Waters and Onshore Geology	5-18
5.1.4.2.1 Nantucket Sound and Lewis Bay Landfall	5-18
5.1.4.2.2 Onshore Cable	5-19
5.1.5 Mitigation	5-20
5.2 Physical Oceanographic Conditions	5-22
5.2.1 Introduction	5-22
5.2.2 Studies Completed	5-22
5.2.2.1 Review of Existing Data	5-22
5.2.2.2 Field Surveys	5-22
5.2.2.3 Existing Conditions Modeling	5-23
5.2.2.4 Model Simulations of Jet Plow Embedment of Cable System	5-23
5.2.3 Existing Conditions	5-24
5.2.3.1 Water Depths/Bathymetry	5-24
5.2.3.2 Currents	5-24
5.2.3.3 Waves	5-25
5.2.3.4 Salinity	5-26
5.2.3.5 Temperature	5-26
5.2.3.6 Sediment Transport Regimes	5-26
5.2.3.7 Ambient Near-Bottom Suspended Sediment Concentrations	5-27
5.2.4 Analysis of Impacts	5-27
5.2.5 Mitigation	5-30
5.3 Benthic and Shellfish Resources	5-31
5.3.1 Introduction	5-31
5.3.2 Studies Completed	5-31
5.3.2.1 Benthic Resources	5-31
5.3.2.2 Shellfish Resources	5-32
5.3.3 Existing Conditions	5-33
5.3.3.1 Benthic Resources	5-33
5.3.3.2 Results of 2001 Benthic Macroinvertebrate Field Sampling Program	5-34
5.3.3.3 Results of 2002 Benthic Macroinvertebrate Field Sampling Program Outside of Massachusetts Waters	5-35
5.3.3.4 Conclusions from Benthic Field Investigations	5-36
5.3.3.5 Shellfish Resources	5-37
5.3.4 Analysis of Impacts	5-40
5.3.4.1 Potential Impacts Outside of Massachusetts Waters	5-40
5.3.4.2 Potential Impacts Inside of Massachusetts Waters	5-45
5.3.4.3 Onshore	5-47
5.3.5 Mitigation	5-47
5.4 Finfish Resources and Commercial/Recreational Fisheries	5-48
5.4.1 Introduction	5-48
5.4.2 Studies Completed	5-49
5.4.2.1 Finfish Resources	5-49
5.4.2.2 Commercial Fisheries	5-50
5.4.2.3 Recreational Fisheries	5-50
5.4.3 Existing Conditions	5-51
5.4.3.1 Habitat Conditions of Nantucket Sound	5-51
5.4.3.2 Finfish Resources	5-51
5.4.3.3 Commercial Fisheries	5-53
5.4.3.4 Recreational Fisheries	5-55
5.4.4 Essential Fish Habitat Assessment	5-57
5.4.5 Analysis of Impacts	5-57
5.4.5.1 Potential Impacts Outside of Massachusetts Waters	5-58

5.4.5.1.1 Direct Impacts	5-58
5.4.5.1.2 Indirect Impacts.....	5-62
5.4.5.1.3 Cumulative Impacts.....	5-63
5.4.5.1.4 Secondary Impacts.....	5-64
5.4.5.2 Potential Impacts Inside of Massachusetts Waters	5-64
5.4.5.2.1 Direct Impacts	5-64
5.4.5.2.2 Indirect Impacts.....	5-66
5.4.5.2.3 Cumulative Impacts.....	5-68
5.4.5.3 Potential Impacts to Commercial and Recreational Fishing Activities and Interaction with Commercial Fishing Gear	5-69
5.4.6 Mitigation.....	5-69
5.5 Protected Marine Species	5-70
5.5.1 Introduction.....	5-70
5.5.2 Studies Completed.....	5-71
5.5.3 Existing Conditions	5-72
5.5.3.1 Federally-Listed Species Protected under the ESA	5-72
5.5.3.2 State Protected Species	5-72
5.5.3.3 Marine Mammals.....	5-73
5.5.4 Biological Assessment (BA).....	5-76
5.5.5 Pinniped Assessment	5-76
5.5.6 Analysis of Impacts.....	5-76
5.5.6.1 Proposed Activities Outside of Massachusetts Waters	5-77
5.5.6.1.1 Potential Direct Impacts.....	5-77
5.5.6.1.2 Potential Indirect Impacts	5-82
5.5.6.1.3 Cumulative Impacts.....	5-85
5.5.6.1.4 Secondary Impacts.....	5-85
5.5.6.2 Proposed Activities Inside of Massachusetts Waters	5-86
5.5.6.2.1 Potential Direct Impacts.....	5-86
5.5.6.2.2 Potential Indirect Impacts	5-89
5.5.6.2.3 Cumulative Impacts.....	5-91
5.5.6.7 Mitigation.....	5-92
5.6 Terrestrial Ecology, Wildlife, and Protected Species	5-92
5.6.1 Introduction	5-92
5.6.2 Studies Completed	5-93
5.6.3 Existing Conditions	5-94
5.6.3.1 Road Segment.....	5-94
5.6.3.2 ROW Segment.....	5-95
5.6.3.3 Bats.....	5-95
5.6.4 Analysis of Impacts.....	5-96
5.6.4.1 Potential Impacts Outside of Massachusetts Waters	5-97
5.6.4.2 Potential Impacts Inside of Massachusetts Waters and Onshore.....	5-97
5.6.4.2.1 Upland	5-97
5.6.4.2.2 Wetland	5-98
5.6.4.2.3 Bats	5-98
5.6.4.3 Cumulative Impacts	5-99
5.6.4.4 Secondary Impacts	5-100
5.6.5 Mitigation.....	5-100
5.7 Avian Resources.....	5-100
5.7.1 Introduction	5-100
5.7.2 Existing Conditions	5-101
5.7.2.1 Overview.....	5-101
5.7.2.2 Data Collection and Applicant Studies	5-102
5.7.2.2.1 Initial Avian Risk Assessment.....	5-102
5.7.2.2.2 Field Studies Conducted By the Applicant	5-104
5.7.2.2.3 Aerial and Boat Surveys	5-104
5.7.2.2.4 Radar Study of Spring and Fall Migration.....	5-106

5.7.2.2.5 Validation of Representative Study Years.....	5-107
5.7.2.3 Results From Data Collected for this EIS.....	5-108
5.7.2.3.1 Waterbirds.....	5-108
5.7.2.3.2 Landbirds.....	5-114
5.7.2.3.3 Radar Study Results.....	5-115
5.7.2.4 Summary of Existing Conditions.....	5-116
5.7.3 Analysis Of Impacts	5-117
5.7.3.1 Potential Impacts during Offshore Construction/Decommissioning	5-118
5.7.3.1.1 Disturbance/Displacement and Habitat Modification	5-118
5.7.3.1.2 Disturbance from Vessel Traffic	5-119
5.7.3.1.3 Effects on Bird Migration	5-120
5.7.3.1.4 Indirect Impacts	5-120
5.7.3.1.5 Cumulative Impacts	5-121
5.7.3.1.6 Secondary Impacts	5-122
5.7.3.2 Potential Impacts during Offshore Operation/Maintenance.....	5-122
5.7.3.2.1 Collision Risk Evaluation.....	5-122
5.7.3.2.2 Disturbance/Displacement by Wind Park.....	5-130
5.7.3.2.3 Lighting	5-132
5.7.3.2.4 Disturbance from Vessel Traffic	5-132
5.7.3.2.5 Effects on Bird Migration	5-133
5.7.3.2.6 Indirect Impacts	5-133
5.7.3.2.7 Cumulative Impacts	5-134
5.7.3.3 Potential Impacts during Onshore Construction and Operation	5-134
5.7.3.4 Potential Impacts to Endangered/Threatened/Other Listed Species.....	5-135
5.7.4 Mitigation.....	5-137
5.7.4.1 Location	5-137
5.7.4.2 Turbine Tower Design	5-138
5.7.4.3 Lighting.....	5-138
5.7.4.4 Height of Turbines in Relation to Avian Flight	5-138
5.7.4.5 Rotor Characteristics	5-138
5.7.4.6 Monitoring	5-139
5.8 Coastal and Freshwater Wetland Resources.....	5-139
5.8.1 Introduction	5-139
5.8.2 Studies Completed	5-140
5.8.3 Existing Conditions.....	5-141
5.8.3.1 Coastal Resources	5-141
5.8.3.1.1 Conditions Outside of Massachusetts Waters.....	5-141
5.8.3.1.2 Conditions Inside of Massachusetts Waters.....	5-141
5.8.3.2 Freshwater Wetlands.....	5-143
5.8.4 Analysis of Impacts	5-145
5.8.4.1 Potential Impacts Outside of Massachusetts Waters	5-146
5.8.4.2 Potential Impacts Inside of Massachusetts Waters.....	5-148
5.8.4.2.1 Lewis Bay	5-148
5.8.4.2.2 Potential Onshore Impacts	5-150
5.8.5 Mitigation.....	5-152
5.8.5.1 Coastal Resources	5-153
5.8.5.1.1 Federal Jurisdiction.....	5-153
5.8.5.1.2 State Jurisdiction	5-153
5.8.5.1.3 Local Jurisdiction	5-159
5.8.5.2 Freshwater Resources	5-160
5.8.5.2.1 Federal Jurisdiction.....	5-161
5.8.5.2.2 State Jurisdiction	5-161
5.8.5.2.3 Local Jurisdiction	5-162
5.9 Water Quality	5-164
5.9.1 Introduction	5-164
5.9.2 Studies Completed	5-165

5.9.3 Existing Conditions	5-165
5.9.4 Analysis of Impacts.....	5-166
5.9.4.1 Potential Impacts Outside of Massachusetts Waters	5-168
5.9.4.2 Potential Impacts Inside of Massachusetts Waters	5-169
5.9.5 Mitigation.....	5-172
5.10 Cultural and Recreational Resources and Visual Studies	5-173
5.10.1 Introduction	5-173
5.10.1.1 Area of Potential Effect	5-173
5.10.1.2 Statutes, Regulations and Regulatory Agency Roles	5-174
5.10.2 Cultural, Recreational and Visual Studies.....	5-175
5.10.2.1 Marine Archaeological Sensitivity Assessment	5-176
5.10.2.2 Marine Reconnaissance Survey of SMDS Area	5-176
5.10.2.3 Marine Archaeological Reconnaissance Survey	5-177
5.10.2.4 Terrestrial Archaeological Reconnaissance and Intensive Surveys.....	5-177
5.10.2.5 Identification of Onshore Historic Properties	5-178
5.10.2.6 Identification of Recreational Resources	5-178
5.10.2.7 Visibility Study	5-179
5.10.2.7.1 Viewshed Reconnaissance	5-179
5.10.2.7.2 Selection of Viewpoints for Visual Simulations	5-179
5.10.2.7.3 Viewpoint Photos.....	5-180
5.10.2.7.4 Visual Character and Setting.....	5-180
5.10.2.7.5 Visual Simulation Methodology.....	5-181
5.10.3 Existing Conditions.....	5-181
5.10.3.1 Conditions Outside of Massachusetts Waters	5-182
5.10.3.1.1 Submerged Prehistoric Archaeological Resources.....	5-182
5.10.3.1.2 Submerged Historic Archaeological Resources	5-184
5.10.3.1.3 Recreational Resources in Federal Waters.....	5-185
5.10.3.1.4 Visual Character and Setting in Federal Waters	5-185
5.10.3.2 Conditions Inside of Massachusetts Waters.....	5-185
5.10.3.2.1 Submerged Prehistoric Archaeological Resources.....	5-185
5.10.3.2.2 Submerged Historic Archaeological Resources	5-186
5.10.3.2.3 Recreational Resources in State Waters	5-186
5.10.3.2.4 Visual Character and Setting in State Waters.....	5-186
5.10.3.3 Onshore	5-186
5.10.3.3.1 Onshore Prehistoric Archaeological Resources	5-186
5.10.3.3.2 Onshore Historic Archaeological Resources	5-187
5.10.3.3.3 Onshore Historic Structures and Districts, Visual Character and Setting	5-187
5.10.3.3.4 Onshore Recreational Resources	5-195
5.10.4 Analysis of Impacts	5-198
5.10.4.1 Impacts Outside of Massachusetts Waters.....	5-198
5.10.4.1.1 Submerged Prehistoric Archaeological Resources.....	5-199
5.10.4.1.2 Submerged Historic Archaeological Resources	5-199
5.10.4.1.3 Recreational Resources in Federal Waters.....	5-199
5.10.4.1.4 Cumulative Impacts	5-200
5.10.4.1.5 Secondary Impacts	5-201
5.10.4.2 Impacts Inside of Massachusetts Waters	5-201
5.10.4.2.1 Submerged Prehistoric and Historic Archaeological Resources.....	5-201
5.10.4.2.2 Recreational Resources	5-201
5.10.4.2.3 Cumulative Impacts	5-202
5.10.4.3 Onshore	5-202
5.10.4.3.1 Onshore Prehistoric and Historic Archaeological Resources	5-202
5.10.4.3.2 Onshore Historic Structures and Districts	5-202
5.10.4.3.3 Onshore Recreational Resources	5-209
5.10.5 Mitigation Summary	5-210
5.11 Noise	5-211
5.11.1 Above Water Sound Analysis.....	5-212

5.11.1.1 Acoustic Concepts	5-212
5.11.1.2 Regulatory Requirements	5-213
5.11.1.3 Existing Conditions	5-213
5.11.1.3.1 Sound Levels at Two Offshore Sites.....	5-213
5.11.1.3.2 Sound Levels at Three Representative Coastal Sites.....	5-214
5.11.1.4 Acoustic Modeling Methodology	5-215
5.11.1.5 Project Impacts.....	5-216
5.11.1.5.1 Impacts Outside of Massachusetts Waters	5-216
5.11.1.5.2 Impacts Inside of Massachusetts Waters – Lewis Bay and Onshore Locations	5-217
5.11.1.5.3 Compliance With the Massachusetts DEP Noise Policy	5-217
5.11.1.6 Construction Impacts.....	5-217
5.11.1.6.1 Construction Impacts Outside of Massachusetts Waters	5-217
5.11.1.6.2 Construction Impacts Inside Massachusetts Waters – Lewis Bay and Onshore Locations.....	5-218
5.11.1.7 Mitigation for Potential Impacts from Noise.....	5-219
5.11.2 Below Water Sound Analysis	5-219
5.11.2.1 Acoustic Concepts	5-219
5.11.2.2 Regulatory Requirements	5-220
5.11.2.3 Existing Conditions	5-220
5.11.2.3.1 Sound Levels at Two Offshore Sites.....	5-220
5.11.2.3.2 Sound Level at Horseshoe Shoal	5-220
5.11.2.4 Acoustic Modeling Methodology	5-220
5.11.2.5 Project Impacts.....	5-221
5.11.2.5.1 Impacts Outside Massachusetts Waters	5-221
5.11.2.5.2 Impacts Inside Massachusetts Waters	5-221
5.11.2.6 Construction Impacts.....	5-221
5.11.2.7 Cumulative Impacts.....	5-221
5.11.2.8 Secondary Impacts.....	5-222
5.11.2.9 Mitigation for Potential Impacts from Noise.....	5-222
5.12 Transportation and Navigation	5-222
5.12.1 Introduction	5-222
5.12.2 Studies Completed	5-223
5.12.3 Existing Conditions	5-224
5.12.3.1 Marine.....	5-224
5.12.3.2 Aeronautical.....	5-225
5.12.3.3 Onshore	5-226
5.12.4 Analysis of Impacts	5-227
5.12.4.1 Impacts Outside of Massachusetts Waters	5-227
5.12.4.1.1 Marine	5-227
5.12.4.1.2 Aeronautical	5-233
5.12.4.2 Impacts Inside of Massachusetts Waters and Onshore.....	5-234
5.12.4.2.1 Lewis Bay	5-234
5.12.4.2.2 Onshore.....	5-236
5.12.5 Mitigation Summary	5-236
5.12.5.1 Marine.....	5-236
5.12.5.2 Aeronautical.....	5-237
5.12.5.3 Onshore	5-237
5.13 Electrical and Magnetic Fields	5-238
5.13.1 Introduction	5-238
5.13.1.1 Overview of Electric and Magnetic Fields	5-238
5.13.1.2 Sources of Exposure to Power Frequency EMF	5-239
5.13.1.3 Current State of EMF Science and Research.....	5-239
5.13.1.4 Human Health Effects Associated with EMF.....	5-240
5.13.1.5 Ecological Health and Exposure Effects Associated with EMF	5-241
5.13.2 Description of Project EMF Studies Completed	5-243
5.13.2.1 Onshore Environment	5-243

5.13.2.2 Marine Environment	5-243
5.13.3 Existing Conditions.....	5-244
5.13.3.1 Conditions Outside of Massachusetts Waters	5-244
5.13.3.2 Conditions Inside of Massachusetts Waters.....	5-244
5.13.3.3 Onshore.....	5-245
5.13.4 Analysis of Impacts.....	5-245
5.13.4.1 Impacts Outside of Massachusetts Waters.....	5-245
5.13.4.2 Impacts Inside of Massachusetts Waters	5-247
5.13.4.3 Onshore	5-248
5.13.5 Mitigation Summary	5-250
5.14 Telecommunications Systems.....	5-251
5.14.1 Introduction	5-251
5.14.2 Studies Completed	5-251
5.14.3 Existing Conditions.....	5-251
5.14.4 Analysis of Impacts.....	5-252
5.14.4.1 Impacts Outside of Massachusetts Waters.....	5-252
5.14.4.2 Impacts Inside of Massachusetts Waters and Onshore	5-253
5.14.5 Mitigation Summary	5-254
5.15 Air and Climate.....	5-254
5.15.1 Introduction	5-254
5.15.2 Studies Completed	5-254
5.15.3 Existing Conditions.....	5-254
5.15.4 Analysis of Impacts	5-255
5.15.4.1 Impacts Outside of Massachusetts Waters.....	5-256
5.15.4.2 Impacts Inside of Massachusetts Waters	5-257
5.15.5 Mitigation.....	5-257
5.16 Socioeconomics.....	5-258
5.16.1 Introduction	5-258
5.16.2 Studies Completed	5-259
5.16.3 Existing Conditions.....	5-259
5.16.3.1 Public Funding and Tax Credits.....	5-259
5.16.3.2 Electricity, Rates and Reliability	5-260
5.16.3.3 Public Health Impacts and Economic Costs from Power Plant Emissions	5-260
5.16.3.4 Local Economy.....	5-261
5.16.3.5 Housing and Coastal Property Values	5-263
5.16.3.6 Tourism and Recreation	5-264
5.16.3.7 Boating	5-264
5.16.3.8 Fishing	5-265
5.16.3.9 Environmental Justice.....	5-266
5.16.4 Proposed Site Conditions and Analysis of Impacts.....	5-267
5.16.4.1 Public Funding and Tax Credits.....	5-267
5.16.4.2 Electricity, Rates and Reliability	5-267
5.16.4.3 Public Health Benefits and Associated Cost Savings	5-269
5.16.4.4 Local Economy.....	5-270
5.16.4.4.1 Economic Impacts During M/A C/I	5-270
5.16.4.4.2 Economic Impacts During O/M.....	5-272
5.16.4.4.3 Tax Revenues and other Fiscal Impacts	5-273
5.16.4.4.4 Economic Benefits at the National Level	5-274
5.16.4.5 Housing and Coastal Property Values	5-274
5.16.4.6 Tourism and Recreation	5-276
5.16.4.7 Boating	5-278
5.16.4.8 Fishing	5-279
5.16.4.9 Environmental Justice.....	5-280
5.16.5 Summary and Conclusion	5-282
5.16.6 Proposed Mitigation Measures.....	5-283
5.17 Summary of Cumulative Impacts	5-284

5.18 References.....	5-285
6.0 COMPREHENSIVE ENVIRONMENTAL MONITORING PROGRAM	6-1
 6.1 Pre-Construction Monitoring.....	6-1
6.1.1 Seabed Conditions Monitoring	6-1
6.1.2 Noise Monitoring.....	6-1
6.1.3 Biological Monitoring	6-2
6.1.3.1 Submerged Aquatic Vegetation.....	6-2
6.1.3.2 Benthic Invertebrate Community and Habitat Conditions	6-2
6.1.3.3 Sea Turtles and Marine Mammals	6-2
6.1.3.4 Birds	6-2
6.1.3.5 State-listed Rare Species.....	6-2
 6.2 Construction Monitoring.....	6-3
6.2.1 Noise Monitoring.....	6-3
6.2.2 Biological Monitoring	6-3
6.2.2.1 Protected Marine Species	6-3
6.2.2.2 State-Listed Rare Species.....	6-3
6.2.3 Erosion Controls	6-3
 6.3 Post-Construction Monitoring	6-4
6.3.1 Seabed Conditions Monitoring	6-4
6.3.2 Noise Monitoring.....	6-4
6.3.3 Biological Monitoring	6-4
6.3.3.1 Submerged Aquatic Vegetation.....	6-4
6.3.3.2 Benthic Invertebrate Community and Habitat Conditions	6-4
6.3.3.3 Sea Turtles and Marine Mammals	6-4
6.3.3.4 Birds	6-4
6.3.3.5 State-Listed Rare Species.....	6-5
7.0 REGULATORY PERMITTING AUTHORITIES AND REGULATORY REVIEWS	7-1
 7.1 Coordinated Review	7-1
 7.2 Federal Regulatory Jurisdictions and Reviews	7-1
7.2.1 Federal Environmental Impact Review	7-1
7.2.2 Federal Permit Reviews	7-2
7.2.2.1 United States Army Corps of Engineers (USACE)	7-2
7.2.2.2 Federal Aviation Administration (FAA)	7-3
7.2.2.3 United States Coast Guard (USCG).....	7-4
7.2.2.4 United States Environmental Protection Agency (USEPA)	7-5
7.2.2.5 Section 106 of the National Historic Preservation Act, as Amended Through 2000.....	7-5
7.2.2.6 National Marine Fisheries Service (NOAA Fisheries)	7-6
 7.3 State Regulatory Jurisdictions and Review.....	7-7
7.3.1 State Environmental Impact Review	7-7
7.3.2 State Permit Reviews	7-8
7.3.2.1 Massachusetts Energy Facilities Siting Board (EFSB)	7-8
7.3.2.2 Massachusetts Department of Environmental Protection (MADEP) – Chapter 91 Waterways License.....	7-9
7.3.2.3 MADEP –Water Quality Certification	7-16
7.3.2.4 Massachusetts Coastal Zone Management (MCZM).....	7-17
7.3.2.5 Massachusetts Highway Department (MHD)	7-21
7.3.2.6 Massachusetts State Archaeologist (MSA), Massachusetts Historical Commission (MHC) ..	7-21
7.3.2.7 Massachusetts Board of Underwater Archaeological Resources (MBUAR).....	7-22
7.3.3 State Regulatory Reviews	7-23
7.3.3.1 Massachusetts Division of Marine Fisheries (MADMF).....	7-23
7.3.3.2 Massachusetts Department of Conservation and Recreation (MADCR)	7-23
7.3.3.3 Massachusetts Historical Commission (MHC)/State Archaeologist.....	7-24
 7.4 Regional Regulatory Jurisdictions and Reviews	7-25
 7.5 Local Regulatory Jurisdictions and Reviews	7-25
7.5.1 Yarmouth Conservation Commission	7-25

7.5.2 Barnstable Conservation Commission	7-26
7.5.3 Yarmouth Department of Public Works	7-27
7.5.4 Barnstable Department of Public Works	7-27
7.6 Consistency with Other Relevant Regulations and Policies	7-28
7.6.1 Consistency with 1997 Electric Utility Industry Restructuring Act.....	7-28
7.6.2 Consistency with Executive Order 385 – Planning for Growth.....	7-28
8.0 CAPE COD COMMISSION DEVELOPMENT OF REGIONAL IMPACT.....	8-1
8.1 Regional Policy Plan Consistency Statement.....	8-1
8.2 Response to Development of Regional Impact Scope.....	8-24
8.2.1 General.....	8-24
8.2.2 Natural Resources	8-27
8.2.3 Economic Development	8-30
8.2.4 Community Facilities	8-30
8.2.5 Historic Preservation / Community Character	8-32
9.0 MEPA DRAFT SECTION 61 FINDINGS (M.G.L. C. 30 § 61).....	9-1
9.1 Mitigation for Potential Geology and Sediment Impacts.....	9-1
9.2 Benthic and Shellfish Impacts	9-2
9.3 Mitigation for Potential Fisheries Impacts	9-3
9.4 Mitigation for Potential Impacts to Protected Marine Species.....	9-3
9.5 Mitigation for Potential Impacts to Terrestrial Ecology, Wildlife, and Protected Species ...	9-3
9.6 Mitigation for Potential Avian Impacts.....	9-4
9.7 Mitigation for Potential Impacts to Freshwater and Coastal Resources	9-4
9.8 Mitigation for Potential Impacts to Water Quality	9-5
9.9 Mitigation for Potential Impacts to Visual, Cultural and Archaeological Resources	9-6
9.10 Mitigation for Potential Impacts from Noise	9-6
9.11 Mitigation for Potential Transportation Impacts.....	9-7
9.12 Mitigation for Potential EMF	9-7
9.12 Telecommunication Impacts.....	9-7
9.14 Mitigation for Potential Air and Climate Impacts	9-8
9.15 Mitigation for Potential Socioeconomic Impacts.....	9-8
10.0 COOPERATING AGENCIES	10-1
11.0 PUBLIC INVOLVEMENT	11-1
12.0 LIST OF PREPARERS	12-1
13.0 INDEX	13-1

List of Tables

Table 1-1:	Project Changes Since Filing the ENF
Table 1-2:	List of Required Permits and Approvals for the Proposed Alternative
Table 3-1:	Natural Gas Fired Power Plant Emissions Estimated Emissions for a 454 MW Facility
Table 3-2:	Summary of The State Of Photovoltaics Research
Table 3-3:	Summary of Renewable Technologies
Table 3-4:	Summary of Upland Alternatives Analysis
Table 3-5:	Summary of Offshore Alternatives Analysis
Table 3-6:	State and Federally Protected Vertebrate Species
Table 3-7:	Common Bird Species of Camp Edwards, Massachusetts Military Reservation
Table 3-8:	Bird Species Observed in Nantucket Sound During 2002-2003
Table 3-9:	Species Observed South of Tuckernuck Island April 14, 2003
Table 3-10:	Birds of Buzzards Bay
Table 3-11:	Summary of Soil, Surficial and Bedrock Geologic Conditions at The Four Alternative Sites
Table 3-12:	Extremal Analysis for Horseshoe Shoal
Table 3-13:	Extremal Analysis for Site Alternative South of Tuckernuck Island
Table 3-14:	Extremal Analysis for New Bedford/Horseshoe Shoal Site Alternative

- Table 3-15a: Finfish and Shellfish Resources within the Offshore Alternatives
- Table 3-15b: Summary of specific life stage EFH designations for species in the NMFS designated 10 x 10 minute squares encompassing the Offshore Alternatives
- Table 3-16: Dominant Benthic Invertebrate Taxonomic Groups of Nantucket Sound
- Table 3-17: Dominant Benthic Invertebrate Taxonomic Groups of the Area South of Tuckernuck Island
- Table 3-18: Dominant Benthic Invertebrate Taxonomic Groups of New Bedford Harbor/Buzzards Bay
- Table 3-19: Reptile and Amphibian Species Observed at MMR
- Table 3-20: Rare, Threatened and Endangered Moths and Dragonflies
- Table 3-21: List of Properties Listed, Determined Eligible, or Evaluated Eligible for the National Register of Historic Places within the viewshed of the Massachusetts Military Reservation Alternative Site. (Includes properties that are within 300 feet of the project boundary and upland areas within view of the project area). Locations are shown on Figure 3-30
- Table 3-22: List of Properties Listed, Determined Eligible, or Evaluated Eligible for the National Register of Historic Places within the proposed Cape Wind—Nantucket Sound Alternatives Project Area. Includes properties that are within 300 feet of the shoreline and within view of the four Nantucket Sound project alternatives. Locations are shown on Figure 3-32
- Table 3-23: List of Properties Listed, Determined Eligible, or Evaluated Eligible for the National Register of Historic Places within the proposed Cape Wind—South of Tuckernuck Island Project Area. Includes properties that are within 300 feet of the shoreline and within view of the project alternative. Locations are shown on Figure 3-33
- Table 3-24: List of Properties Listed, Determined Eligible, or Evaluated Eligible for the National Register of Historic Places within the proposed Cape Wind—New Bedford Alternative Project Area. Including properties within 300 feet of the shoreline and within view of the proposed wind park alternative. Locations are shown in Figure 3-34. (See Table 3-22 for properties within the reduced Horseshoe Shoal Combo area)
- Table 3-25: Recreational Resources Within Viewshed of the MMR Alternative Site
- Table 3-26: Recreational Resources Within Viewshed of Horseshoe Shoal Offshore Alternative Site
- Table 3-27: Recreational Resources Within Viewshed of Monomoy and Handkerchief Shoals Offshore Alternative Site
- Table 3-28: Recreational Resources Within Viewshed of Tuckernuck Shoal, Offshore Nantucket Sound
- Table 3-29: Recreational Resources Within Viewshed of the Alternative Site South of Tuckernuck Island
- Table 3-30: Recreational Resources Within Viewshed of the New Bedford/Buzzards Bay Offshore Alternative
- Table 3-31: Existing Sound Levels At Three Representative Coastal Sites (dBA)
- Table 3-32: Summary of Palustrine Wetland Types at MMR
- Table 3-33: Representative Temperature Data
- Table 3-34: Air Quality Monitor Information
- Table 3-35: Mean Wind Speeds within the Nantucket Sound Area
- Table 3-36: Barnstable County Baseline Conditions
- Table 3-37: Representative Property Tax Revenues
- Table 3-38: Housing Occupancy in Barnstable and Yarmouth
- Table 3-39: Housing Occupancy in Bourne and Sandwich
- Table 3-40: Bristol County Baseline Conditions
- Table 3-41: Property Tax Revenues for New Bedford
- Table 3-42: Housing Occupancy in New Bedford
- Table 3-43: Environmental Justice Statistics
- Table 3-44: Comparison of Existing Conditions in 2001
- Table 3-45: Summary of Onshore and Offshore Costs per Installed KW
- Table 3-46: Decommissioning Cost Estimate
- Table 3-47: Installed Cost
- Table 3-48: Economic Comparison of Alternatives
- Table 3-49: Estimated Operation and Maintenance Costs
- Table 3-50: Plant Community/Cover Type Distributions within Potential Project Area of Disturbance (400-foot/122 m Diameter Buffer from Towers and 20-foot/6 m Offset Buffer from Cables)
- Table 3-51: Area of Temporary and Permanent Impact (in Acres) Associated with Alternatives located in Nantucket Sound, South of Tuckernuck Island and New Bedford Harbor/Horseshoe Shoal
- Table 3-52: Land/Vegetation Disturbance Impacts (see Figures 3-44 and 3-51)

- Table 3-53: Historic Properties Selected for Offshore Photo Renderings
- Table 3-54: Comparison of the Maximum Onshore Sound Level from Wind Park Operation at the Horseshoe Shoal Site and Other Alternative Locations
- Table 3-55: Potential Hazards and Applicable Regulations During Construction and Decommissioning
- Table 3-56: Potential Hazards and Applicable Regulations During Operation and Maintenance
- Table 3-57: Summary of Characteristics of the Wind Park Alternatives
- Table 3-58: Summary of Nantucket Sound Alternatives Analysis
- Table 3-59: Summary of Alternative Routes
- Table 3-60: Individual Ranking Score Criterion Value
- Table 3-61: Summary of Individual Scores and Weighted Scores of Alternative Transmission Line Routes
- Table 3-62: Costs for Alternative Routes
- Table 5.1-1: Equipment Used for Cape Wind Project Geophysical/Hydrographic Survey
- Table 5.1-2: Summary of Marine Vibracore Information
- Table 5.1-3: Bulk Physical Analysis Results and Sediment Classification of Marine Vibracore Samples
- Table 5.1-4: Summary of Sediment Chemical Analytical Results (Metals, Total Organic Carbon, Total Petroleum Hydrocarbons)
- Table 5.1-5: Summary of Sediment Chemical Analytical Results (PCB Congeners and Pesticides)
- Table 5.1-6: Summary of Sediment Chemical Analytical Results (Polynuclear Aromatic Hydrocarbons)
- Table 5.3-1: Summary statistics for invertebrate data collected from within and outside the three mile limit, August, 2001
- Table 5.3-2: Total landings of shellfish species from Nantucket Sound, from 1990 through 2000
- Table 5.3-3: Summary of Maximum Anticipated Temporary and Permanent Impacts to Benthic Habitat
- Table 5.4-1: Likelihood of occurrence for species collected during MDMF spring research trawl surveys at the Proposed Wind Park site (HSS) in Nantucket Sound
- Table 5.4-2: Likelihood of occurrence for species collected during MDMF fall research trawl surveys at the Proposed Wind Park site (HSS) in Nantucket Sound
- Table 5.4-3: Number of surveys conducted in Dukes, Barnstable and Nantucket counties
- Table 5.4-4: Summary of specific life stage EFH designations for species in the NMFS designated 10 x 10 minute squares encompassing the Proposed Site in Nantucket Sound
- Table 5.4-5: Summary of studies on acoustic impacts to fish
- Table 5.7-1: Aerial Survey Coverage and Percentage of Each Alternative Site Flown During all Systematic Surveys
- Table 5.7-2: Summary of Dates, Times, Weather and Water Conditions during the 28 Aerial Surveys in Nantucket Sound, 2002-2003
- Table 5.7-3: Bird Species Observed in the Study Area from March 2002 through June 2003
- Table 5.7-4: Species Totals: Individuals Recorded within the Study Area during Twenty-Eight Aerial Surveys
- Table 5.7-5: Species Totals: Individuals Recorded within the Study Area during the Boat Surveys
- Table 5.7-6: Species Totals: Individuals Recorded within the Study Area during the Groundtruthing Surveys
- Table 5.7-7: Percentage of Seaducks Observed in Each Shoal Area during March 2002 through June 2, 2003 Aerial Surveys
- Table 5.7-8: Percentage of Terns Observed in Each Shoal Area during March 2002 through June 2, 2003 Aerial Surveys
- Table 5.8-1: Coastal Wetland Resources
- Table 5.8-2: Freshwater Wetland Resources
- Table 5.8-3: Impacts from Onshore Transmission Line
- Table 5.10-1: Historic Properties and Districts Assessed for Potential Wind Park Visibility
- Table 5.10-2: Visual Simulation Locations
- Table 5.10-3: Viewpoint Data
- Table 5.10-4: Compilation of Recreational Resources Within Viewshed of Wind Park
- Table 5.10-5: Recommended Section 106 Findings of Effect for Aboveground Historic Properties Within the Cape Wind Project Visual APE
- Table 5.11-1: Threshold of Human Hearing
- Table 5.11-2: Various Indoor and Outdoor Sound Levels
- Table 5.11-3: Existing Sound Levels at Three Representative Coastal Sites
- Table 5.11-4: Locations Selected for Modeling Sound Effects of the Project

- Table 5.11-5: Maximum Continuous Sound Levels from Project Operation Compared to Baseline Sound Levels (Leq) at Buoys G5 and R20
- Table 5.11-6: Maximum Continuous Sound Levels from Project Operation Compared to Baseline Sound Levels (Leq) at Lewis Bay Upland Locations for the Cut-In Wind Speed Condition
- Table 5.11-7: Maximum Continuous Sound Levels from Project Operation Compared to Baseline Sound Levels (Leq) at Lewis Bay Upland Locations for the Design Wind Speed Condition
- Table 5.11-8: MADEP Noise Policy Compliance Demonstration for All Modeling Locations (dBA)
- Table 5.11-9: Predicted Above Water Maximum Sound Levels (Lmax) at Two Seaward Locations Near the Wind Park from Pile Driving for the Wind Park Foundations (dBA)
- Table 5.11-10: Predicted Above Water Maximum Sound Levels (Lmax) at Upland Locations from Pile Driving for the Wind Park Foundations (dBA)
- Table 5.11-11: Predicted Underwater Continuous Sound Levels from Project Operation for the Design Wind Condition
- Table 5.13-1: Peak Magnetic Field Levels Above 115 kV Circuits
- Table 5.13-2: Most Lightly Loaded 33 kV Cable
- Table 5.13-3: Most Heavily Loaded 33 kV Homerun Cable
- Table 5.13-4: ESP Peak Magnetic Field Levels Over the 33kV Cables
- Table 5.13-5: Range of EMF Exposure Levels
- Table 5.13-6: Maximum Magnetic Flux Density (mG)
- Table 5.13-7: Maximum Magnetic Flux Density (mG)
- Table 5.13-8: Maximum Net Magnetic Fields
- Table 5.13-9: Biological Process Strength Compared to EMF interaction Strength
- Table 5.13-10: State Transmission Line Standards and Guidelines
- Table 5.16-1: Estimated Annual Health Impacts for Actual Emissions from the Salem Harbor and Brayton Point Power Plants from the Harvard Study (Levy et al., 2000)¹
- Table 5.16-2: Housing Occupancy in Barnstable and Yarmouth
- Table 5.16-3: Calculation of Wind Park Offset Ratios
- Table 5.16-4: Pollutant Emission Reductions using Wind Park Average Contribution (Tons/Year)
- Table 5.16-5: Calculated Yearly Emission Reductions from the Cape Wind Project
- Table 5.16-6: Estimated Health Effect Offsets from Proposed Wind Park Extrapolated from Levy et al. (2000) and Levey and Spengler (2002) (Events per Year)
- Table 7-1: Summary of Regulatory Review and Jurisdiction

List of Figures

- Figure 1-1: Cape Wind Project Locus
- Figure 3-1: New England Wind Resource Mapping
- Figure 3-2: Wind Energy Resource and Coastal bathymetry Map of Nantucket Sound and Horseshoe Shoal
- Figure 3-3: Upland Alternative: Massachusetts Military Reservation/Otis Air Force Base Sandwich, Massachusetts
- Figure 3-4: Upland Alternative: Searsburg, Vermont Existing Facility
- Figure 3-5: Upland Alternative: Princeton, Massachusetts
- Figure 3-6: Upland Alternative: Skinner/Kibby Township, Maine
- Figure 3-7: Upland Alternative: Redington Pond/Black Nubble Mountain, Maine
- Figure 3-8: Upland Alternative: Connecticut Department of Transportation Site Brownfield
- Figure 3-9: Upland Alternative: City of Greenfield, Massachusetts Landfill Site
- Figure 3-10: Upland Alternative: Florida, Massachusetts Hoosac Site
- Figure 3-11: Offshore Alternative: Block Island, Rhode Island
- Figure 3-12: Offshore Alternative: Martha's Vineyard, Massachusetts
- Figure 3-13: Offshore Alternative: Cape Ann, Massachusetts
- Figure 3-14: Offshore Alternative: Vinalhaven Island, Maine
- Figure 3-15: Offshore Alternative: Nantucket Shoals, Massachusetts
- Figure 3-16: Offshore Alternative: Nantucket Sound, Massachusetts
- Figure 3-17: Offshore Alternative: Boston Harbor, Massachusetts
- Figure 3-18: Offshore Alternative: New Bedford, Massachusetts
- Figure 3-19: Offshore Alternative: Portland, Maine

- Figure 3-20: Overview of Representative Alternative Sites
Figure 3-21: Terrestrial Alternative: Massachusetts Military Reservation Proposed Site Boundary
Figure 3-22: Nantucket Sound Alternative Proposed Site Boundaries
Figure 3-23: South of Tuckernuck Alternative Proposed Site Boundaries
Figure 3-24: Combination Alternative: New Bedford/Buzzard's Bay and Reduced Horseshoe Shoal Proposed Site Boundaries
Figure 3-25: Depth to Top of Bedrock
Figure 3-26: New Bedford Harbor Superfund Site
Figure 3-27: Buzzard's Bay Vicinity Map
Figure 3-28: New Bedford Harbor – Commercial and Recreational Fishing Closure Areas
Figure 3-29: FAA – Instrument Flight Rule (IFR) Routes
Figure 3-30: Location of Properties Listed, Determined Eligible, or Evaluated Eligible for the National Register of Historic Places within the Viewshed of the Massachusetts Military Reservation Alternative Site
Figure 3-31: Massachusetts Military Reserve Terrestrial Alternative Site Boundary
Figure 3-32: Location of Properties Listed, Determined Eligible, or Evaluated Eligible for the National Register of Historic Places within the proposed Cape Wind-Nantucket Sound Alternatives Project Area
Figure 3-33: Location of Properties Listed, Determined Eligible, or Evaluated Eligible for the National Register of Historic Places within the proposed Cape Wind-South of Tuckernuck Island Project Area
Figure 3-34: Location of Properties Listed, Determined Eligible, or Evaluated Eligible for the National Register of Historic Places within the proposed Cape Wind-New Bedford Alternative Site
Figure 3-35: Generic Seascape to Represent Existing Water Views At Shoreline Locations
Figure 3-36: Existing View of MMR Alternative Site From Sagamore Bridge, Cape Cod Canal - Southbound
Figure 3-37: Recreational Resources within Viewshed of the MMR Alternative
Figure 3-38: Recreational Resources within Viewshed of the Nantucket Sound Offshore Alternative
Figure 3-39: Recreational Resources within Viewshed of the South of Tuckernuck Offshore Alternative
Figure 3-40: Recreational Resources within Viewshed of the New Bedford/Buzzards Bay Offshore Alternative
Figure 3-41: Noise Receptors and Sound Monitoring Locations Surrounding the Alternative Sites
Figure 3-42: Community Wind Collaborative Wind Resources MMR Alternative Site
Figure 3-43: Wind Energy Resource and Coastal bathymetry Map of Nantucket Sound and Horseshoe Shoal
Figure 3-44: Terrestrial Alternative: Massachusetts Military Reservation Proposed Site Layout
Figure 3-45: Proposed Wind Turbine Generator Foundation Types
Figure 3-46: Nantucket Sound Alternatives Proposed Site Layouts
Figure 3-47: South of Tuckernuck Alternative Proposed Site Layout
Figure 3-48: Combination Alternative: New Bedford/Buzzard's bay and Reduced Horseshoe Shoal Proposed Site Layouts
Figure 3-49: Maintenance Accessibility Wave Frequency At Martha's Vineyard Coastal Observatory
Figure 3-50: Maintenance Accessibility Wave Frequency At Cape Wind Tower
Figure 3-51: Anticipated Area of Project Impact by Cover Type
Figure 3-52: Indicator Map of Magnetic Material in Soil at the Massachusetts Military Reservation Alternative Site
Figure 3-53: Potential View From Sagamore Bridge, MA
Figure 3-54: Potential View From Wianno, Barnstable, Cape Cod – Horseshoe Shoal Alternative Daytime View
Figure 3-55: Potential View From Wianno, Barnstable, Cape Cod – Horseshoe Shoal Alternative Nighttime View
Figure 3-56: Potential View From Monomoy Shore, Chatham, Cape Cod – Handkerchief Shoal Alternative Daytime View
Figure 3-57: Potential View From Monomoy Shore, Chatham, Cape Cod – Handkerchief Shoal Alternative Nighttime View
Figure 3-58: Potential View From Cape Poge, Martha's Vineyard – Tuckernuck Shoal Alternative Daytime View
Figure 3-59: Potential View From Cape Poge, Martha's Vineyard – Tuckernuck Shoal Alternative Nighttime View
Figure 3-60: Potential View From Madaket Shoreline, Nantucket – Tuckernuck Island Alternative Daytime View
Figure 3-61: Potential View From Madaket Shoreline, Nantucket – Tuckernuck Island Alternative Nighttime View
Figure 3-62: Potential View From Wianno, Barnstable, Cape Cod – Horseshoe Shoal Reduced Size Alternative Daytime View

- Figure 3-63: Potential View From Wianno, Barnstable, Cape Cod – Horseshoe Shoal Reduced Size Alternative Nighttime View
- Figure 3-64: Potential View From South Dartmouth, MA – New Bedford Alternative Daytime View
- Figure 3-65: Potential View From South Dartmouth, MA – New Bedford Alternative Nighttime View
- Figure 3-66: Nantucket Sound Alternatives Nantucket Sound, Massachusetts
- Figure 3-67: Alternative Transmission Line Routes And Landfall Locations Nantucket Sound
- Figure 3-68: Submarine and Upland Transmission Line Routes Alternative Routes #1, 5, and 6
- Figure 3-69: Submarine and Upland Transmission Line Routes Alternative Routes #2, 3, and 4
- Figure 3-69a: Submarine and Upland Transmission Line Routes Eastern Portion of Alternative Routes #2, 3, and 4
- Figure 4-1: Cape Wind Project Locus
- Figure 4-2: Preliminary Turbine Array
- Figure 4-3: Proposed Wind Turbine Generator
- Figure 4-4: Typical Offshore Wind Turbine Generator
- Figure 4-5: Typical 3.6 MW WTG Nacelle
- Figure 4-6: Typical Foundation Types
- Figure 4-7: Proposed Electric Service Platform Elevation & Plan View
- Figure 4-8: Preliminary Inner-Array Layout
- Figure 4-9: Typical Profile: 33 kV Solid Dielectric Submarine Cable
- Figure 4-10: Typical Profile: 115 kV Solid Dielectric Submarine Cable
- Figure 4-11: Typical Profile: 115 kV Solid Dielectric Upland Cable
- Figure 4-12: Yarmouth Preferred Interconnection with Barnstable Switching Station
- Figure 4-13: Typical "8 over 8" Ductbank Cross Section
- Figure 4-14: Typical "4 over 4" Ductbank Cross Section
- Figure 4-15: 115 kV Landfall Transition Vault
- Figure 4-16: 115 kV Upland Transition Vault
- Figure 4-17: 115 kV Upland Splice Vault
- Figure 4-18: Typical Installation Vessel
- Figure 4-19: Preliminary Scour Analysis
- Figure 4-20: Typical Cross Section of Submarine Cable Trench Using Jet Plow Embedment
- Figure 4-21: Landfall Transition: Conceptual Design Plan
- Figure 5.1-1: Geophysical and Geological Marine Field Program
- Figure 5.1-2: Depth to Top of Bedrock
- Figure 5.1-3: Profile of 2001 Geophysical Trackline G-13 and Boring GZA-SB-02
- Figure 5.1-4: Representative Side Scan Sonar Images--Horseshoe Shoal
- Figure 5.1-5: Surface Sediment Types
- Figure 5.1-6: 2003 Hydrographic and Sand Wave Data
- Figure 5.3-1: Total annual shellfish landings in Nantucket Sound from 1994 – 2001
- Figure 5.3-2: Total annual conch landings from fish pots in Nantucket Sound from 1992 to 2000
- Figure 5.3-3: Total annual shellfish landings in Nantucket Sound from 1990 – 2000
- Figure 5.3-4: Total annual lobster landings from Nantucket Sound from 1990 – 2000
- Figure 5.3-5: Mean monthly lobster landings from Nantucket Sound from 1990 – 2000
- Figure 5.3-6: Town of Yarmouth Recreational Shellfish Area (Colonial Acres to Englewood Breakwater)
- Figure 5.3-7: Town of Yarmouth Recreational Shellfish Area (Mill Creek)
- Figure 5.3-8: Town of Yarmouth Aquaculture Lease Sites
- Figure 5.3-9: Designated Shellfish Growing Area Classifications in Lewis Bay
- Figure 5.4-1: Mean CPUE across years for Horseshoe Shoal, Monomoy-Handkerchief Shoal and Tuckernuck Shoal for the fall and spring trawl surveys
- Figure 5.4-2: Commercial landings of finfish and squid from 1994 through 2001 as reported from NMFS vessel trip reports for statistical sub-area 075
- Figure 5.4-3: Top 10 species of finfish and squid landed in Nantucket Sound from 1994 through 2001 as reported from NMFS vessel trip reports for statistical sub-area 075
- Figure 5.4-4: Total landings from fish weirs in Nantucket Sound from 1990 through 2000
- Figure 5.4-5: Total landings from gill nets in Nantucket Sound for years gill nets were fished within the Sound
- Figure 5.4-6: Total sea bass and scup landings from fish pots in Nantucket Sound
- Figure 5.4-7: Mean monthly striped bass landings from Nantucket Sound from 1990 - 2000

- Figure 5.4-8: Total annual striped bass landings from Nantucket Sound from 1990 - 2000
- Figure 5.4-9: Mean number of hours fished by wave as reported by recreational anglers in Dukes, Barnstable and Nantucket counties from 1990 through 2001
- Figure 5.4-10: Mean number of hours fished by individual anglers calculated from all surveys conducted in Dukes, Barnstable and Nantucket counties
- Figure 5.4-11: Percent of anglers reporting mode of fishing as shore, party/charter boat, or private/rental boat from surveys conducted from 1990 through 2001 in Dukes, Barnstable and Nantucket counties
- Figure 5.4-12: Total number of fish reported by anglers and observed by interviewers by fishing mode in Dukes, Barnstable and Nantucket counties from 1990 through 2001
- Figure 5.6-1: Natural Heritage & Endangered Species Program Classification
- Figure 5.7-1: Study Area, Alternatives, and Important Features for the Cape Wind Project.
- Figure 5.7-2: Individual Loons per km² for Aerial Surveys March 2002 –June 2003
- Figure 5.7-3: Individual Grebes per km² for Aerial Surveys March 2002 –June 2003
- Figure 5.7-4: Individual Wilson's Storm-Petrels per km² for Aerial Surveys March 2002 –June 2003
- Figure 5.7-5: Individual Gannets per km² for Aerial Surveys March 2002 –June 2003
- Figure 5.7-6: Individual Cormorants per km² for Aerial Surveys March 2002 –June 2003
- Figure 5.7-7: Individual Eiders per km² for Aerial Surveys March 2002 –June 2003
- Figure 5.7-8: Individual Long-tailed Ducks per km² for Aerial Surveys March 2002 –June 2003
- Figure 5.7-9: Individual Scoters per km² for Aerial Surveys March 2002 –June 2003
- Figure 5.7-10: Individual Goldeneyes per km² for Aerial Surveys March 2002 –June 2003
- Figure 5.7-11: Individual Mergansers per km² for Aerial Surveys March 2002 –June 2003
- Figure 5.7-12: Individual Gulls per km² for Aerial Surveys March 2002 –June 2003
- Figure 5.7-13: Individual Terns per km² for Aerial Surveys March 2002 –June 2003
- Figure 5.7-14: Individual Razorbills per km² for Aerial Surveys March 2002 –June 2003
- Figure 5.8-1: Wetlands on Onshore transmission line Route, Yarmouth, Massachusetts
- Figure 5.8-2: Wetlands Resource Maps
- Figure 5.8-3: Lake and Pond Recharge Areas
- Figure 5.8-4: Coastal Watershed Areas
- Figure 5.9-1: Water Protection Areas
- Figure 5.9-2: Zone I Areas for Preferred Route
- Figure 5.9-3: DEP Approved Zone IIs Along the Preferred Route
- Figure 5.9-4: Groundwater Contours Along the Preferred Route
- Figure 5.10-1: Viewshed Reconnaissance for Designated Historic Properties
- Figure 5.10-2: Character Photographs (Sheets 1-64)
- Figure 5.10-3: Simulated Day time Views (Sheets 1-12)
- Figure 5.10-4: Simulated Night time Views (Sheets 1-11)
- Figure 5.10-5: GIS-Listed Recreational Resources With Potential Views of the Wind Park
- Figure 5.12-1: Channels and Navigational Features – Nantucket Sound
- Figure 5.12-2: Aeronautical Navigation Features
- Figure 5.12-3: Proposed US Coast Guard Aid to Navigation Lighting
- Figure 5.12-4: Proposed FAA Aviation Lighting
- Figure 7.1: Regulatory Jurisdiction
- Figure 8-1: Preliminary Alignment Sheets - Preferred Route

Appendices

- Appendix 2.0-A Natural Gas in the New England Region: Implications for Offshore Wind Generation and Fuel Diversity
- Appendix 2.0-B Looking Ahead to 2010 Natural Gas Markets in Transition
- Appendix 3-A: Wind Energy as a Siting Criteria for Potential Wind Parks
- Appendix 3-B: Hydrodynamic Effects on Offshore Wind Turbine Support Structures
- Appendix 3-C: Transmission Issues for Offshore Wind Farms
- Appendix 3-D: Potential 345 kV Expansion to Remove Current Transmission Constraint of ISO-New England's Maine - New Hampshire Interface
- Appendix 3-E: Peer Review Summary Report
- Appendix 3-F: Garrad Hassan Report – Review of Offshore Wind Farm Project Features

Appendix 3-G:	Marine Protected Species Descriptions
Appendix 3-H:	Essential Fish habitat (EFH) Designation Descriptions
Appendix 3-I:	PAL Archaeological Sensitivity Assessments for the Alternative Analysis
Appendix 3-J:	ComSearch Licensed Microwave Search and Worst Case Fresnel Zone – Alternative Analysis
Appendix 3-K:	Photo Rendering Methodology
Appendix 3-L:	MMR REPORT
Appendix 4.0-A:	Scour Analysis
Appendix 5.1-A:	Geotechnical Borings Correlated to Geophysical Data
Appendix 5.2-A:	Analytical Modeling of Alternative Wind Farm Sites - Existing Conditions
Appendix 5.2-B:	Coastal Engineering Design Parameter Analysis Phase I - Preliminary
Appendix 5.2-C:	Results of Model Simulations of Sediment Deposition from Cable Burial Operations in Lewis Bay, MA
Appendix 5.3-A:	Benthic Study 2001
Appendix 5.3-B:	Benthic Study 2002
Appendix 5.3-C:	Lewis Bay Shellfish and Benthic Survey 2003
Appendix 5.4-A:	Fisheries Data Report
Appendix 5.4-B:	Recreational Intercept Survey Report
Appendix 5.4-C:	Essential Fish Habitat Assessment
Appendix 5.5-A:	Biological Assessment for Marine Threatened/Endangered Species
Appendix 5.5-B:	Pinniped Assessment
Appendix 5.6-A:	Terrestrial Ecology Correspondence
Appendix 5.7-A:	Preliminary Avian Risk Assessment for the Cape Wind Energy Project
Appendix 5.7-B:	A Comparison of the Years 2002-2003 with the Years 1989-2001, Using Historic Data on Winter Waterbirds
Appendix 5.7-C:	Terns (Aves: Sterninae) And The Cape Wind Project In Nantucket Sound
Appendix 5.7-D:	Late Winter/Early Spring 2002 Waterbirds Survey for the Cape Wind Energy Project
Appendix 5.7-E:	Spring/Fall 2002 Avian Radar Studies for the Cape Wind Energy Project
Appendix 5.7-F:	Spring/Summer 2002 Waterbirds Survey for the Cape Wind Energy Project
Appendix 5.7-G:	Fall 2002 - Winter 2003 Waterbirds Survey for the Cape Wind Energy Project
Appendix 5.7-H:	Evaluation of the Roseate Tern and Piping Plover
Appendix 5.7-I:	Biological Review of the Common Tern for the Cape Wind Project
Appendix 5.7-J:	Bird Monitoring Using the Mobile Avian Radar System (MARS) Nantucket Sound, Massachusetts (Geo-Marine, Inc. Radar Report)
Appendix 5.7-K:	Six Surveys of Waterbirds in Nantucket Sound: March 19 – June 2, 2003 for the Cape Wind Energy Project
Appendix 5.7-L:	Summer 2003 Waterbird Survey for the Cape Wind Energy Project
Appendix 5.7-M:	Fall 2003 - Winter 2004 Waterbirds Survey for the Cape Wind Energy Project
Appendix 5.7-N:	Massachusetts Audubon Society Nantucket Sound Tern Surveys
Appendix 5.10-A:	Visual Simulation Methodology by EDR
Appendix 5.10-B:	Known Historic Properties Within Potential Visual Range of the Wind Park
Appendix 5.10-C:	Marine Cultural Resource Reports by PAL: C-1: Marine Archaeological Sensitivity Assessment C-2: Marine Archaeological Reconnaissance Survey
Appendix 5.10-D:	Terrestrial Cultural Resource Report by PAL: Terrestrial Archaeological Reconnaissance Survey Terrestrial Route Alternatives #1 and #2, and Intensive (Locational) Archaeological Survey, Terrestrial Route Alternative #1
Appendix 5.10-E:	Regulatory Correspondence
Appendix 5.10-F:	Visual Impact Assessment of Multiple Historic Properties
Appendix 5.10-G:	Draft Programmatic Agreement
Appendix 5.11-A:	Noise Report
Appendix 5.12-A:	USCG Correspondence
Appendix 5.12-B:	Navigational Risk Assessment
Appendix 5.12-C:	FAA Determinations
Appendix 5.13-A:	Preliminary Assessment of the Electric and Magnetic Field Impacts Associated With The Cape Wind Park For The Preferred Alternative
Appendix 5.14-A:	ComSearch Licensed Microwave Search and Worst Case Fresnel Zone – Horseshoe Shoal

- Appendix 5.14-B: Report on Horns-Rev VHF Radio and Marine Radar
 Appendix 5.16-A: Impact Analysis of the Cape Wind Off-Shore Renewable Energy Project on Local, State, and Regional Economies
 Appendix 5.16-B: La Capra Need Analysis
 Appendix 7.0-A: Regulatory Correspondence
 Appendix 7.0-B: MEPA Response to Comments and Comment Letters
 Appendix 8.0-A: DRI Requirements
 Appendix 11.0-A: USACE Public Notice

Acronyms and Abbreviations

AC	Alternating Current
ACEC	Areas of Critical Environmental Concern
ACHP	Advisory Council on Historic Preservation's
ACK	Nantucket Memorial Airport
ADCP	Acoustic Doppler Current Profiler
Amp	Amps
ANOVA	Analysis of Variance
APCC	Association for the Preservation of Cape Cod
APE	Area of Potential Effect
ASA	Applied Science Associates, Inc.
asl	Above Mean Sea Level
ASTM	American Society for Testing Materials
ATON	Aids-to-Navigation
AWOIS	Automated Wreck and Obstruction Information System
B.P.	Before Present
BA	Biological Assessment
BACT	Best Available Control Technology
BEA	Bureau of Economic Analysis
BIG	Biomass Integrated Gasification
BMP	Best Management Practices
BP	Before Present
BR	Biological Review
BVW	Bordering Vegetated Wetland
BWEA	British Wind Energy Association
C/I	Construction/Installation
CBC	Christmas Bird Counts
CCC	Cape Cod Commission
CCCT	Combined Cycle Combustion Turbine
CCGT	Combined Cycle Gas Turbines
CEQ	Council on Environmental Quality
CFB	Circulating Fluidized Bed
CFR	Code of Federal Regulations
CGP	Construction General Permit
cm	centimeters
CMR	Code of Massachusetts Regulations
CO	Carbon Monoxide
CO2	Carbon Dioxide
CPUE	Catch Per Unit Effort
CRM	Cultural Resource Management
CWA	Clean Water Act
CZM	Coastal Zone Management
d/b/a	Doing Business As
dB	Decibels
dba	A-weighted Decibels
DBL	Un-weighted or linear Decibels

DC	Direct Current
DCR	Department of Conservation and Recreation
DEIR	Draft Environmental Impact Report
DEIS	Draft Environmental Impact Statement
DFW	Department of Fish and Wildlife
DGPS	Differential Global Positioning System
DGPS	Differential Satellite Global Positioning System
DOE	Department of Energy
DOER	Department of Energy Resources
DOT	Department of Transportation
DPA	Designated Port Area
DPW	Department of Public Works
DRI	Development of Regional Impact
DTE	Department of Telecommunication & Energy
DVAR	Dynamic VAR Control
EDR	Environmental Design & Research, P.C.
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EFSB	Energy Facilities Siting Board
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EJ	Environmental Justice
EMF	Electric And Magnetic Fields
EMF-RAPID	Electric and Magnetic Fields Research and Public Information Dissemination Program)
ENF	Environmental Notification Form
ENF	Environmental Notification Form
EOEA	Executive Office of Environmental Affairs
EPA	Environmental Protection Agency
EPA	Environmental Protection Agency
EPRI	Electric Power Research Institute
ER-L	Effects Range-Low
ER-M	Effects Range-Median
ESA	Endangered Species Act
ESP	Electric Service Platform
ESW	Extreme Storm Wave
FAA	Federal Aviation Administration
FADs	Fish Aggregating Devices
FCC	Federal Communication Commission
FEIR	Final Environmental Impact Report
FEIS	Final Environmental Impact Statement
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FIRM	Flood Insurance Rate Map
FIS	Full Instrumentation Suite
Fpm	Flashes per Minute
FR	Federal Register
FT	Feet
FY	Fiscal Year
G	Gauss
GHG	Greenhouse Gas
GHz	GigaHertz
GIS	Geographic Information Systems
GIS	Generator Information System
GPD	Gallons Per Day
GPS	Global Positioning Systems
GWh	Gigawatt hour

HAPs	Hazardous Air Pollutants
HDD	Horizontal Directional Drilling
HD	Horizontal Directional Drilling
HDPE	High Density Polyethylene
HSS	Horseshoe Shoal
HVAC	High Voltage Alternating Current
HVDC	High Voltage Direct Current
Hz	Hertz
I/O	Input/Output
IALA	International Association Of Marine Aids To Navigation And Lighthouse Authorities
IBA	Important Bird Area
ICBM	Intercontinental Ballistic Missiles
ICNIRP	International Commission on Non-Ionizing Radiation Protection
IFR	Instrument Flight Rules
IGCC	Integrated Gasification Combined Cycle
IMPROVE	Interagency Monitoring of Protected Visual Environments
ISO	Independent System Operator
ISO-NE	Independent System Operator - New England
kHz	Kilohertz
km	Kilometer
km/hr	Kilometer Per Hour
km2	Kilometer Squared
km2	square kilometer
kV	Kilovolt
kV/m	Kilovolt per meter
KVA	kilovolt amp
kw	Kilowatt
kw·h	kilowatt hours
L90	Background Sound Level
LAER	Lowest Achievable Emission Rate
lb/MMBTU	Pounds per Million British Thermal Units
lbs/year	pounds per year
LED	Light emitting diode
Leq	Equivalent Sound Level
Lmax	Maximum Sound Level
LNG	Liquefied Natural Gas
LOA	Length Over-all
LPSW	Long Period Sand Wave
LSCSF	Land Subject to Coastal Storm Flowage
LUWW	Land Under Waterbodies and Waterways
m	meter
M.G.L.	Massachusetts General Law
M/A	Manufacturing and Assembly
m/sec	meters per second
m2	Meters Squared
MAARNG	Massachusetts Army National Guard
MACRIS	Massachusetts Cultural Resource Information System
MADCR	Massachusetts Department of Conservation and Recreation
MADMF	Massachusetts Department of Marine Fisheries
MAFMS	Mid-Atlantic Fishery Management Council
MARS	Mobile Avian Radar System
MAS	Massachusetts Audubon Society
MassGIS	Massachusetts Geographic Information System
MBUAR	Massachusetts Board Of Underwater Archaeological Resources
MCZM	Massachusetts Coastal Zone Management
MDET	Massachusetts Division of Employment and Training

MDMF	Massachusetts Division Of Marine Fisheries
MDMF	Massachusetts Division of Marine Fisheries
MEPA	Massachusetts Environmental Policy Act
MESA	Massachusetts Endangered Species Act
mG	milliGauss
mg/L	Milligram Per Liter
mg/m ³	Micrograms per Cubic Meter
MGL	Massachusetts General Law
MHC	Massachusetts Historical Commission
MHD	Massachusetts Highway Department
MHW	Mean High Water
MHz	Mega Hertz
mi ²	square mile
MLLW	Mean Lower Low Water
MLW	Mean Low Water
mm	millimeter
MMPA	Marine Mammal Protection Act
MMR	Massachusetts Military Reservation
MMS	Mineral Management Service
MNHESP	Massachusetts Natural Heritage Endangered Species Program
MOU	Memorandum of Understanding
mPa	MicroPascals
mph	Miles Per Hour
MPS	Minimum Performance Standard
MRFSS	Marine Recreational Fisheries Statistics Survey
MRFSS	Marine Recreational Fisheries Statistics Survey
MSA	Massachusetts State Archaeologist
MSL	Mean Sea Level
MTC	Massachusetts Technology Collaborative
MW	Megawatt
MWh	Megawatt hour
NAAQS	National Ambient Air Quality Standards
NBDC	National Data Buoy Center
NECMA	New England County Metropolitan Area
NEFMC	New England Fishery Management Council
NEPA	National Environmental Policy Act
NEPOOL	New England Power Pool
NGVD	National Geodetic Vertical Datum
NHESP	Natural Heritage and Endangered Species Program
NHPA	National Historic Preservation Act
NIEHS	National Institute of Environmental Health Sciences
NIH	National Institute of Health
NM	Nautical Mile
NMFS	National Marine Fisheries Service
NO ₂	Nitrogen Dioxide
NOAA	National Oceanic And Atmospheric Administration's
NOI	Notice of Intent
NOx	Nitrogen Oxides
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NRCS	Natural Resource Conservation Service
NRHP	National Register Of Historic Places
NRIS	National Register Information System
NSA	Non-seasonally adjusted
NWI	National Wetlands Inventory
O&M	Operation And Maintenance

OCS	Outer Continental Shelf
OSHA	Occupational Safety and Health Association
OSI	Ocean Survey Inc.
OTR	Ozone Transport Region
PAH	Polynuclear Aromatic Hydrocarbons
PAL	Public Archaeology Laboratory, Inc.
PATON	Private Aids to Navigation
PCBs	Polychlorinated Biphenyls
PCS	Personal Communication Systems
PEM	Palustrine Emergent Marsh
PH	Priority Habitat
PM	Particulate Matter
PM-10	Particulate Matter Less Than 10 Microns in Diameter
PM2.5	Particulate Matter Less Than 2.5 Microns In Diameter
POC	Point of Contact
ppb	Parts Per Billion
PPE	Personal Protection Equipment
ppm	Parts Per Million
PPS	Palustrine Scrub Shrub
ppt	parts per thousand
psi	pounds per square inch
PTC	Production Tax Credits
PUC	Public Utilities Commission
Pv	Photovoltaic
PVC	Polyvinyl Chloride
RACT	Reasonably Achievable Control Technology
RECs	Renewable Energy Credits
REPP	Renewable Energy Policy Project
RFA	Riverfront Area
RFR	Radio frequency Radiation
RIS	reduced instrument suite
RIS	Reduced Instrumentation Suite
ROD	Record of Decisions
ROI	Region Of Impact
ROW	Right-of-way
Rpm	revolutions per minute
RPS	Renewable Portfolio Standard
RTE	Rare, Threatened, Or Endangered
SAR	Search and Rescue
SAV	Submerged aquatic vegetation
SCADA	Supervisory Control and Data Acquisition
SHPO	State Historic Preservation Officer
SHPO/MHC	State Historic Preservation Officer/Massachusetts Historic Commission
SIC	Standard Industrial Classification
SIP	State Implementation Plan
SLBM	Sea Launched Ballistic Missiles
SMAST	School for Marine Science and Technology
SMD	System Market Design
SMDS	Scientific Measurement Devices Station
SO2	Sulfur Dioxide
SOF	Statement of Findings
SPCC	Spill Prevention Control And Countermeasure
SPSW	Short Period Sand Wave
SRHP	State Register Of Historic Places
SRHP	State Register of Historic Place
SSPARS	Solid State Phased Array Radar Systems

STI	South Of Tuckernuck Island
SWPPP	Stormwater Pollution Prevention Plan
T	Telsa
TCLP	Toxicity Characteristic Leaching Procedure
THPO	Tribal Historic Preservation Officer
TMDL	Total Maximum Daily Loads
TOC	Total Organic Carbon
TPH	Total Petroleum Hydrocarbons
TPY	Tons Per Year
TSS	Total Suspended Sediments
UHF	Ultra High Frequency
USACE	United States Army Corps Of Engineers
USACE-NED	United States Army Corps of Engineers – New England Division
USCG	United States Coast Guard
USDOE	United States Department of Energy
USDOI-MMS	United States Department of Interior – Minerals Management Service
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UXO	Unexploded Ordnance
V/m	Volts per Meter
VFR	Visual Flight Rules
VHF	Very High Frequency
VOC	Volatile Organic Compounds
VOC	Volatile Organic Compounds
VPs	Viewpoints
W/m ²	Watts Per Square Meter
WH	Estimated (Wetland) Habitat
WHO	World Health Organization
WIS	Wave Information Study
WPA	Wetlands Protection Act
WQC	Water Quality Certification
WTG	Wind Turbine Generator
XLPE	extruded cross-linked polyethylene
YWD	Yarmouth Water Department